Air Force Research Laboratory|AFRL

Science and Technology for Tomorrow's Air and Space Force

SUCCESS STORY

AFRL DEMONSTRATES AIRBORNE ACTIVE FLOW CONTROL SYSTEM

Active flow control technology has the potential to reduce air vehicle weight, complexity, and radar signature and eliminate the need for air vehicle control surfaces. In addition, this technology promises to reduce buffeting of external aircraft stores while the aircraft travels at transonic speeds; thus, scientists can eliminate the operational restrictions incurred from integrating stores (e.g., weapons) onto aircraft.

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Accomplishment

AFRL recently demonstrated the first airborne active flow control system to reduce turbulent airflow in the wake of an external pod, which experts mounted on an aircraft. For this demonstration, engineers outfitted an F-16 aircraft with a Low-Altitude Navigation and Targeting Infrared for Night (LANTIRN) system pod. Scientists augmented the LANTIRN system pod with several small, electrically controlled piezoelectric synthetic jet (PESJ) actuators.

These actuators received the air that flowed over the pod surface and ejected the air to significantly affect the dynamic pressure of the pod's wake. Each PESJ actuator measured approximately 1/2 in. thick with a 3 in. diameter. Despite the PESJ actuators' size, just 6 units produced dramatic results.

This demonstration was possible through AFRL's collaboration with the US Air Force Test Pilot School, the Air Force Institute of Technology, General Electric, and Lockheed Martin. The team developed an airborne wind tunnel system that allowed evaluation of this active control system in the real world as opposed to the traditional wind tunnel environment.

Background

Part of an AFRL multiphase research program, this effort's next phases will focus on the integration of piezoelectric vibration suppression actuators into the F-16 ventral fin, the evaluation of additional flow control actuator concepts, and the development of synergistic design concepts leveraging both flow and structural control systems to optimize system performance.

Buffeting occurs when high-performance aircraft operate at high speeds. During these conditions, vortices emanate from the leading edge of aircraft structures and create turbulent flows and dynamic loads that vibrate the structure. Prolonged buffeting can cause fatigue damage that restricts aircraft capability and availability.

Air Vehicles
Emerging Technology

Additional Information

To receive more information about this or other activities in the Air Force Research Laboratory, contact TECH CONNECT, AFRL/XPTC, (800) 203-6451 and you will be directed to the appropriate laboratory expert. (VA-S-05-29)